
# Epidemiology of Tuberculosis In Seattle and King County

# Annual Report 2001

**Tuberculosis Control Program**
**Public Health – Seattle and King County**

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## EXECUTIVE SUMMARY

In 2001, there were 139 cases of tuberculosis reported in Seattle and King County. This represents a 34% increase over the last two years. These data suggest that what was thought to be a one-time increase in the number of TB cases in 2000 might actually be part of an important trend. King County last reported 139 or more cases 21 years ago when there were 148 cases in 1980. A look at case numbers from 1969 to the present suggests that the steady decrease in case numbers through the 1970s and early 1980s has ended as we enter the new century. Reversing this trend will require a strengthening of efforts on several fronts. Core TB control functions must be maintained, new approaches and research must be pursued, and broad-based community strategies involving health partners, educators and the affected communities must be expanded.

While the increase in the number of TB cases is concerning, other data suggest that those with TB are undergoing and completing appropriate treatment and that the TB Program at Public Health—Seattle and King County continues to serve the community well. This is supported by the percent of multi-drug resistant TB (MDRTB) cases remaining at 1% over the past decade. Nationwide the rate of MDR TB has declined from 2.5% in 1993 to 1% in 2001, although Washington State reported 2.3% MDR TB and eight other states reported between 2.1 and 4.3% MDR TB in 2001. This finding suggests that the initial drug selection and treatment compliance failures that have caused MDRTB in other jurisdictions are not occurring in Seattle and King County. Additionally, the percent of cases with disease relapse among previously treated cases is 5%, which matches the best rates published in controlled treatment trials, indicating effective completion of therapy. These findings demonstrate the effectiveness of the program's directly observed therapy (DOT) program, which delivered over 8,000 doses of medicine to TB patients during 2001. They also demonstrate the effectiveness of the program's intensive and highly individualized approach to patient management.

Approximately two-thirds of cases of active tuberculosis cases in Seattle and King County are managed by the TB Clinic, most of these by DOT. Program staff establishes trusting relationships with TB patients and assesses each one for the need for DOT and incentives and enablers such as food and housing that may be needed to ensure completion of therapy. The other one-third of cases are managed by pulmonologists, infectious disease specialists, and primary care providers in the community which maintains a broad level of expertise and awareness of this disease in the larger medical community.

The TB Program has responded aggressively to epidemiological trends in recent years, culminating in important achievements during 2001.

- It completed a large project of cultural case management for targeted testing and treatment of latent TB infection among new refugees that included partnership with the Community Housecalls Program of Harborview Medical Center and a combination of public and private funding. This project has been presented at national and international meetings, has been emulated nationally, and has been submitted for publication in a major medical journal. Most unfortunately, the TB Program has been unable to continue the project after the grant funds ended due to a lack of local resources to pick up the increased costs.
- The program also successfully competed to join two major new CDC-sponsored initiatives:
  1) Tuberculosis Epidemiological Studies Consortium (TBESC) which is developing and performing a ten-year federal agenda for programmatic research in TB control
  2) A study in collaboration with programs in San Diego and Hawaii of contact investigations of foreign-born persons.
  Contact investigations find individuals with new TB infection, who are among the most important to treat because of their relatively high risk of quickly developing active disease.
- The program also initiated development of universal strain typing of TB isolates at a local laboratory for molecular epidemiology. Strain typing shows patterns of TB transmission that may or may not otherwise be suspected and can assist in the evaluation of suspected false-positive cultures (positive cultures in low-risk persons) which can result from cross-contamination in the laboratory. The project is a collaborative public-private academic effort.
- The program continues to participate in the Tuberculosis Trials Consortium (TBTC), a ten-year CDC-sponsored program of trials of new diagnostic and treatment regimens for TB infection and disease.
- Finally, the program continues to encourage development of the Washington State TB Advisory Council, which acquired co-sponsorship from the American Lung Association of Washington and the Firland Foundation, increasing its effectiveness as a forum for involving professional and lay communities in expanding TB control efforts.

Challenges for the TB Program are to maintain performance of core functions, to work with the community in expanding effective partnerships – especially for targeted testing and treatment of latent TB infection – and to continue to expand its research program. This program will continue to find new approaches and resources to allow it to reverse the present trend of increasing numbers of new cases of tuberculosis and to match the national trend in recent years of declining case numbers, in order to achieve Public Health's stated goal of achieving TB elimination.

# EPIDEMIOLOGY OF TUBERCULOSIS IN SEATTLE-KING COUNTY

## TOTAL CASES

**Data.** One hundred thirty-nine (139) cases of tuberculosis were reported in Seattle & King County during 2001 as compared to 127 cases in 2000 and 104 cases in 1999. This represents a 9% and 34% increase, respectively. During the same periods, Washington State had 261 cases in 2001, 258 cases both in 2000 and in 1999. For 2001, King County represents 53% of the State's cases, while in 2000 it represented 49% of the cases (127/258).

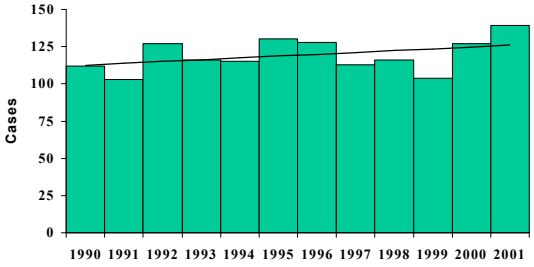


**Figure 1: Tuberculosis in Seattle-King County 1990-2001**

The incidence (new cases) of tuberculosis in Seattle-King County in 2001 was 8 cases/100,000 King County residents using 2000 census data. This compares with 4.4 cases/100,000 for the State and 5.6 cases/100,000 for the U.S.

King County last reported 139 or more cases in 1980, with 148 cases. Figure 2 illustrates the TB case numbers from 1969 to the present and suggests that the steady decrease in case numbers through the 1970s and early 1980s has reversed. Seattle and King County appear to be experiencing an increasing trend in TB case numbers as we enter the new century. Reversing this trend will require a concerted effort, and may be successful with a multifaceted, community-based approach to tuberculosis control, in concert with the Washington State TB Advisory Council – including categorical public health efforts, innovative partnerships with and education of local health care providers, and involvement of representatives of the affected communities.

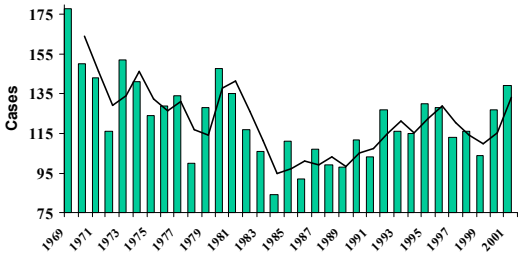


**Figure 2: Tuberculosis in Seattle-King County 1969-2001**

**Findings from Total Case Data.**

- The number of TB Cases in King County is rising,
- King County represents a much larger percent of Washington State's TB cases than it does of the state's population.
- 2001 data suggest that what was thought to be a one-time increase in the number of TB cases in 2000 may actually be part of an ongoing, trend (figure 2).

## DEMOGRAPHICS

**Data.** The table below displays the basic demographic data for the 2001 King County TB cases.

| Demographic | # | % | Demographic | # | % |
|---|---|---|---|---|---|
| Gender | | | Race/Ethnicity | | |
| Male | 84 | 60% | Asian/Pacific Islander | 60 | 43% |
| Female | 55 | 40% | Black, non-Hispanic | 35 | 25% |
| | | | White, non-Hispanic | 26 | 19% |
| | | | Hispanic | 11 | 8% |
| Age (years) | | | Native American | 5 | 4% |
| 0 – 4 | 4 | 3% | Unknown | 2 | 1% |
| 5 – 14 | 4 | 3% | | | |
| 15 – 34 | 57 | 41% | Employment Status | | |
| 35 – 64 | 53 | 38% | Not employed in past 24 months | 49 | 35% |
| 64+ | 21 | 15% | Health care worker | 9 | 6% |

**Table 1: Number and percent of 2001 TB cases in King County by selected demographic variables**

There were 107 foreign-born cases reported in 2001 (77% of all cases) and these accounted for 58% (7/12) of the increase in total cases from 2000 (n=100) and 97% (34/35) of the increase from 1999 (Figure 3). The most frequent countries of birth of 2001 foreign-born cases were Vietnam (17), Philippines (16), Ethiopia (12), and Somalia (12).

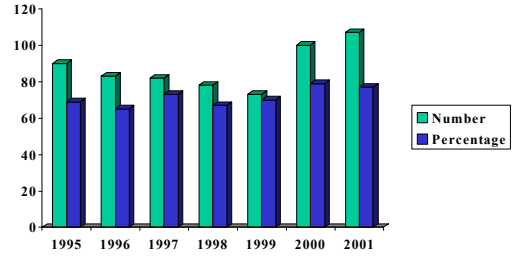


**Figure 3: Tuberculosis in Foreign-born Persons, Seattle-King County 1995-2001**

The trend of increasing cases among African immigrants that was reported last year continues. Twenty-seven cases born in Africa, 25% of the foreign-born number, were reported in 2001, an 8% increase compared to 2000. 12 cases came from Ethiopia, twelve from Somalia, and 1 each from Kenya, Rwanda, and Uganda.

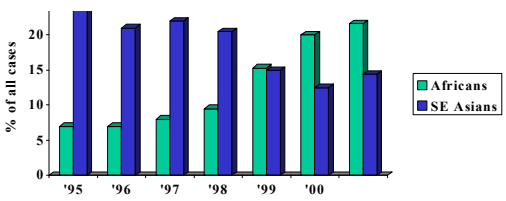


**Figure 4: Tuberculosis morbidity in two immigrant/refugee groups, Seattle-King County 1995-2001**

As reported last year, this trend appears to have begun in 1998, and it appears approximately to mirror a decreasing trend of new cases among immigrants from Southeast Asia (Figure 4).

For 2001, 12 (9%) of our TB cases were homeless at the time of diagnosis, for an incidence of 163 cases per 100,000 homeless persons. The Seattle/King County Coalition for the Homeless estimated that 7,350 individuals were homeless in 2001, 0.4% of the King County population. This number of homeless TB cases has been fairly constant the last few years, with the exception of a temporary increase in 1998 that was attributed mostly to a single cluster of cases, although the rate of TB among homeless persons has declined as the number of homeless persons has risen.

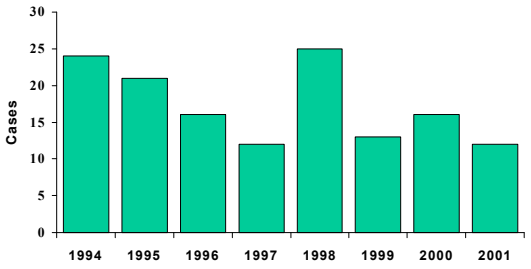


**Figure 5: Tuberculosis in homeless persons Seattle-King County 1994-2001**

**Findings from Demographic Data.**

- Males outnumber female TB cases by 1.5 to 1.
- Most cases (79%) are among working age adults.
- Foreign-born cases represented over three-quarters of the TB cases in King County.
- Number of foreign-born cases from Africa has exceeded the number of cases from SE Asia for the past two years.
- The other social risk factor for TB disease in King County is homelessness.

## HIV AND TB

**Data.** Nine (9) of the TB cases in 2001 were co-infected with HIV (6.47%) (Figure 6).

One hundred one (73%) of all cases were tested for HIV infection. Eighty-two percent of cases in the highest risk ages 25-44 were tested (46/56). The program continues to try to increase HIV testing to meet the CDC recommendation that all TB cases receive HIV testing, but it does exceed the CDC's minimum standard of testing 75% of cases in the 25 to 44 year age group.

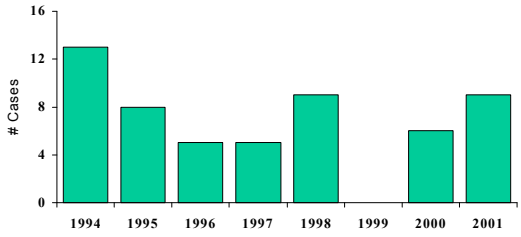


**Figure 6: TB in HIV-Infected Persons Seattle-King County 1994-2001**

HIV-infected TB cases counted during the last two years were evaluated further in order to evaluate the current local epidemiology of this potentially explosive combination

of diseases. No HIV-infected cases were reported during 1999. Of the 15 HIV-infected cases reported in 2000 and 2001, 12 (80%) were foreign-born. Among the 12 male HIV-infected cases, 9 were foreign-born (Rwanda, Somalia, Mexico [2], Jamaica, Cuba, Zaire, Guatemala, Nicaragua) and 3 US-born. Among the three female HIV-infected cases, 2 were foreign-born (Canada and Malawi) and 1 US-born. Six HIV-infected cases were homeless, all male, 4 of them foreign-born (Guatemala, Jamaica, Nicaragua, Mexico).

**Findings from the HIV Data.**

- HIV infection is the third important risk factor for tuberculosis in King County, in addition to and overlapping with foreign birth and homelessness.
- Foreign-born, HIV-infected cases come from 10 different countries

## SUSPECTED TB CASE REPORTS

**Data.** During 2001 the TB Control Program received 344 reports of suspected TB cases, a 37% increase compared to 2000 (252 suspects). Suspect reports originate with medical providers who encounter persons with illnesses consistent with TB in the course of their practices. Washington Law requires that such patients be reported, because important public health interventions, such as investigation of contacts, may be indicated immediately, even before the diagnosis is certain. Reporting of suspected tuberculosis cases therefore is an indicator of the awareness of TB by medical practitioners of Seattle-King County. It is also a measurement of work burden for the TB Program Staff, as reported TB suspects often require consultation, contact investigations, and monitoring of clinical status, cultures, and compliance with treatment, even though in 2001 only 40% of reported suspects become actual cases of TB.

**Findings for Suspected TB Case Reports.**

- The increased suspect/case ratio in 2001 of 2.5 (344/139) compared to 2.0 (252/127) in 2000 indicates both high awareness of TB in our community and a high-priority work-load imposed by this disease on Public Health's TB Control Program that is not reflected by case numbers alone.

## CLINICAL EPIDEMIOLOGY

**Data.** One hundred twenty-nine (129) cases had information on previous TB diagnosis. Seven (5%) of these reported previously having been diagnosed with TB disease.

Overall, 126 (91%) of diagnosed cases were verified by positive cultures. Results of sensitivity testing results have been recorded on 123 (98%) of these cases.

| Drug(s) Resistance | # | % (of 123 total) |
|---|---|---|
| Isoniazid resistance | 12 | 10% |
| Rifampin resistance | 2 | 2% |
| Resistance to drugs other than isoniazid and rifampin (mostly streptomycin) | 20 | 16% |
| Isonaizid + rifampin resistance (MDR-TB)[1] | 1 | 1% |
| Resistance to 2 or more drugs, but not the combination of isoniazid + rifampin | 9 | 7% |

**Table 2: Drug resistance among 2001 cases**

These drug resistance rates have been stable to declining slightly for the past decade (Figure 7). Treatment of MDR-TB tends to be much more complicated, costly, and lengthy in comparison to treatment of cases with sensitivity to one or both of the most effective TB drugs, isoniazid, and rifampin. Inadequate or inappropriate treatment can lead to the development of MDR-TB and a consistently low rate of this form of the disease is one measure of effective TB control.

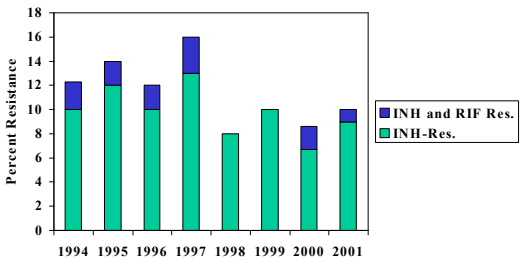


**Figure 7: Drug resistance in TB Cases, 1994 - 2001**

Seventy-four (53%) cases had only pulmonary TB, 54 (39%) had only extra pulmonary TB, and 10 (7%) had both pulmonary and extra-pulmonary TB, with one case not having a disease site stated. Of the 84 total pulmonary TB cases, 38 (45%) were sputum smear positive[2] and 70 (83%) were sputum culture positive.[3] The 23 sputum smear negative – culture positive cases show effective early case finding of individuals whose disease has not progressed to a stage of severe illness or of high infectiousness.

Length of residence in the United States prior to diagnosis continues to follow national trends and also helps to identify high-risk populations among which to apply targeted prevention measures. Among the 107 foreign-born cases, approximately half of cases were diagnosed within the first five years of arrival in the United States, the interval during which the ATS and CDC have recommended targeted testing and treatment for persons arriving from areas of the world where TB is endemic. Cumulatively, 14 (13%) of cases were diagnosed within one year, 21 (20%) within two years, 44 (41%) within five years, 64 (60%) within 10 years, 79 (74%) within 20 years. The final 13 (12%) were diagnosed 20 years or more after arrival.

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1 Multi-drug resistant TB (MDR-TB) is defined as resistance to isoniazid and rifampin, with or without resistance to other drugs.

2 Expectorated sputum examined under a microscope in the laboratory and found to show bacteria typical of TB bacteria is considered to be "smear positive."

3 Concurrent with microscopic examination, sputum is inoculated onto several types of culture media. If *Mycobacterium tuberculosis* complex grows in any of these media, the specimen is considered "culture positive."

Eight cases (6%) had contact with active TB within the previous two years. Recent contact with infectious TB is one of the most important risk factors for developing active disease. Half of the lifetime risk of developing active disease occurs in the first two years after developing new infection. Diagnosing a case of TB in a person with recently acquired and untreated infection identifies an important missed prevention opportunity.

Five King County residents (4%) died with pulmonary tuberculosis, three of them within two weeks of being hospitalized for severe respiratory symptoms.
Of these three:

- One was a 76-year-old US-born white man with no known TB risk factors;
- One was a 47-year-old, homeless, HIV infected, Hispanic man who had immigrated from Mexico 25 years before
- One was a 30-year-old woman, who came to this country from India while in her twenties.

With the others:

- The fourth death was of another 76-year-old, US-born, white man with pulmonary TB who died of renal failure unrelated to his tuberculosis, several months into his course of TB treatment.
- The fifth death was of an 80-year-old man from the Philippines who died of metastatic lung cancer before a TB diagnosis was also made from a sputum culture that was AFB-smear-negative.

**Findings from Clinical Epidemiology.**

- The relapse rate of 5% matches nationally reported effectiveness of curative therapy for TB.
- Drug resistance rates of 10% for isoniazid-resistance and 1% for MDR-TB are stable and suggest that current approaches to treatment of active disease in our community are effective.
- Thirty-nine percent of cases had no pulmonary involvement, in comparison with the national average of 25%, showing a higher proportion of less common presentations of disease. These are also often more complicated and expensive to treat.
- A high proportion of smear-negative, culture-positive cases, which are less infectious and usually less advanced, suggests a combination of effective screening and case-finding activities.
- Four deaths from far-advanced disease, occurring very soon after diagnosis and before effective treatment could make a difference, are examples of failures of early case finding.

# TB PROGRAM HIGHLIGHTS FOR 2001

## OVERVIEW

Approximately two-thirds of cases of active tuberculosis are managed by the TB Clinic, most of these by directly observed therapy. By having pulmonologists, infectious disease specialists, and primary care providers continue to manage some cases of tuberculosis outside of Public Health's TB Clinic, our community maintains a broad level of expertise and awareness of this disease, that might not continue if all TB care were concentrated in a single categorical TB Program.

## DIRECTLY OBSERVED THERAPY (DOT)

The TB Program's Directly Observed Therapy (DOT) Team delivered approximately 8,000 doses of TB medication directly to patients in the community during 2001. The average monthly DOT roster in 2001 numbered 67 cases, with a range of 55 to 82. All reported cases are considered for DOT, though in some cases direct observation may be a disincentive to treatment and an individual physician may determine that it is not appropriate for selected patients.

## GRANT FUNDED ACTIVITY AND COMMUNITY PARTNERSHIPS

The TB Program does not receive sufficient local funds to address all of the high priority activities of a comprehensive TB control and prevention program. As such, those funds are supplemented with federal and other grant funds, a portion of which are applied to research that dovetails nicely with the provision of pubic health TB services.

**TB Trials Consortium (TBTC).** In 1999 the TB Program became one of 23 academic and public health sites in the United States and Canada to participate in an ongoing CDC-sponsored TB Trials Consortium (TBTC). This consortium is continuing the long and successful tradition of U.S. Public Health Service trials of new diagnostic and treatment approaches to TB. Current studies include:

- evaluation of rifabutin-containing regimens for treating HIV-infected persons with tuberculosis
- evaluation of three-drug intermittent therapy for individuals with isoniazid-resistance or intolerance
- evaluation of a once-weekly, twelve-dose, directly-observed regimen of isoniazid and

rifapentine for treatment of latent TB infection, in comparison to the now standard 9-month regimen of self-supervised daily isoniazid.

Recent consortium studies have demonstrated the efficacy and safety of once-weekly rifapentine and isoniazid treatment in the continuation phase of treatment for selected patients with pulmonary TB.

**TB Epidemiologic Studies Consortium (TBESC).** During 2001 the Program successfully competed to be one of the inaugural sites for the TB Epidemiologic Studies Consortium (TBESC), a 10-year project, modeled on the successes of the TBTC and designed to support large studies of operational, epidemiological, laboratory, and economic issues in TB control. Seventeen local and regional leaders in public health, academic medicine, and epidemiology wrote letters of support and commitment to participate in future TBESC projects, creating a basis for developing strong public health/academic collaborations.

Early TBESC activity included setting up the national and local staffing and procedures that comprise the framework within which specific subsequent projects will be developed.

**CDC Funded Contact Investigations Grant.** The Program also joined a two-year, three-site, CDC sponsored study of contact investigations among Foreign-Born persons in 2001. The other two sites are the TB programs of San Diego, California, and the State of Hawaii.

**CDC funded Prevention Partnerships.** An ongoing CDC-funded project of partnerships with community clinics for targeted testing and treatment also shows significant progress in expanding access to populations at risk for TB infection and at increasing acceptance and completion of treatment for latent infection.

**Federal and Private Foundation Funded Cultural Case Management of Latent TB Infection.** The TB Control Program and Harborview Medical Center's Community House Calls Program concluded a two and a half year program during 2001 that piloted a socially supportive, case-management program for TB prevention services by hiring and training recent immigrants to work as outreach workers in their communities. These workers would call, visit, educate, and encourage patients under treatment for active and latent tuberculosis, and serve as cultural mediators between patients and their health care providers. The workers also assisted with resettlement issues unrelated to TB, such as social needs, education, and other health issues. Treatment acceptance and completion were compared for new refugees from the countries of Somalia, former Yugoslavia, and the former Soviet Union, the targeted communities, before and during the pilot program. The acceptance rate for treatment of latent TB infection among refugees in the targeted communities increased from 51% (46/90) in 1998, the year prior to the start up, to 86% (224/260) in 2000, and the rate of treatment completion increased from 50% (23/46) to 87% (194/224).

Despite the success of this program, after the grant funds ended, the Department was no longer able to support this enhanced service with its current local funding level.

**TB Strain Typing.** Another new initiative in 2001 grew out of program staff participation in the University of Washington's Mycobacteria Interest Group. This is a forum for a very active group of basic science researchers in the departments of Pathobiology, Immunology, Medicine, and Pediatrics, including researchers from the Seattle Biomedical Research Institute (SBRI). Molecular strain typing is performed by restriction fragment length polymorphism (RFLP) and spoligotyping, which are internationally standardized methods of "fingerprinting" the DNA of M. tuberculosis strains. The results resemble bar codes that are specific, or nearly so, to individual strains. With technical support and encouragement from the CDC and from the previously assigned but currently overburdened Arkansas reference laboratory, an SBRI laboratory is currently validating its strain-typing methods for TB isolates. If successful, during 2002 this laboratory will perform the universal strain typing that is urgently needed to determine, for example, whether most cases represent activation of previously acquired TB infection or whether ongoing transmission is occurring in our community. Strain typing can confirm or disprove suspected clusters of transmission. It will also help to evaluate the occasional suspected false-positive isolate of TB bacteria that might be a result of cross-contamination within a laboratory. Findings from strain typing will help Public Health to focus targeted testing and treatment resources better to prevent future cases of TB.

**Washington State TB Advisory Council.** The Washington State TB Advisory Council (WSTAC), comprised of tuberculosis controllers and other health care professionals, as well as representatives of communities affected by tuberculosis, became increasingly effective during 2001 as a forum for involving professional and lay communities in expanding TB control efforts. Since King County consistently reports above 40% of TB cases in the state, it is appropriate that the council has significant representation by Seattle and King County providers and organizations.

## TB PROGRAM CHALLENGES

Challenges for the TB Program in the present year are to maintain performance of core functions, to work with the community in expanding effective partnerships – especially for targeted testing and treatment of latent TB infection – and to continue to expand its research program. This program needs to continue to find new approaches and resources to allow it to reverse increasing case numbers and to match the national trend of recent years toward achieving elimination.

Reinvigorating treatment of refugees and other immigrants with latent TB infection remains an important priority for Seattle and King County if future TB cases are to be prevented. Anecdotal evidence suggests that few refugees – or other patients – with TB infection referred to community providers outside of carefully structured, Public Health-supported programs actually start and complete treatment. Furthermore, new refugees comprise only a small fraction of new foreign-born residents, according to U.S. Department of Justice data. Many of the non-refugee residents have the same risk factors for TB infection and are even more marginalized from health care services, including TB testing and treatment. Other points of access to non-refugee immigrants at high risk for TB infection must be identified if the testing, follow-up, and treatment structure and resources are to be developed. Finding and supporting new and proven methods for targeted testing and treatment of latent TB infection among these and other high-risk populations will acquire increasing priority in coming years.